

*John A. O'Toole*

John A. O'Toole

1/8/02



30173

PATENT & TRADEMARK OFFICE

## TITLE OF THE INVENTION

### LAMINATED MULTI-LAYERED CEREAL PRODUCTS AND METHODS OF 5 PREPARATION

## BACKGROUND OF THE INVENTION

[001] The present invention relates to food products and to their methods of preparation. In particular, the present invention relates to cereal products especially ready-to-eat cereals and/or cooked grain based snacks composed of thin laminated layers with interstitial voids that create a pastry-like texture, and to their methods of preparation.

[002] Ready-to-eat ("R-T-E") cereals, often called breakfast cereals, are popular food items. Such food products are dried food products generally prepared from pieces fabricated from cooked cereal doughs. Snack food products prepared from cooked cereal doughs can be similar although are generally pieces of larger size often dried by deep fat frying, e.g., corn chips.

[003] R-T-E cereals have been prepared in a wide variety of shapes, sizes, compositions, textures, flavors and the like. Efforts continue in the art to develop R-T-E cereals having new shapes or structures, textures or eating sensations and visual appeal or appearance.

[004] The present invention is directed towards R-T-E cereals and grain based snack products of novel structure, eating sensation, and appearance as well as to practical methods for their large 20 scale or commercial manufacture. In particular, the present invention is directed towards R-T-E cereal pieces characterized by a highly laminated structure comprising a multiplicity of generally horizontally aligned thin parallel layers with interstitial voids.

[005] R-T-E cereals of more than one layer are known. Products comprising two or three layers are particularly well known. However, products having more than three layers are less 25 well known due to manufacturing difficulties in fabrication and drying of the intermediate layers. For these and other reasons, such products are generally fabricated from multiple layers of open nets or weaves. In particular, biscuits comprising multiple layers of webs or filaments

are popular cereals. Often such products include an intermediate fruit paste layer and/or a topical sugar coating layer often on one or both major faces.

[006] Biscuits of compressed flakes from individual cooked grain berries are also known, with the flakes randomly compressed into a molded biscuit. However, the flakes are randomly oriented not generally horizontally aligned. Also, the flakes are much smaller averaging less than 40 mm<sup>2</sup>. Such biscuits can include added particulates such as fruit and nuts compressed with the flakes, and can be topically coated.

[007] Multicolored two-ply R-T-E cereals are also known (see, for example, U.S. 4,940,593, issued July 10, 1990 to D. K. Duffy entitled "Multicolored R-T-E Cereal and Method of Preparation") that rely upon using a highly puffable cereal dough such as rice flour. Puffed three ply cereals are also known (see for example, US 5,558,890 entitled "Multi-layered Puffed R-T-E Cereal and High Intensity Microwave method of Production" issued Sept. 24, 1996 to Brown et al. which is incorporated herein by reference). The products and methods of preparation in the '890 patent relied upon employment of high intensity microwave puffing which has not proven to be commercially practical.

[008] Also known are biscuits comprising exterior layers fabricated from cooked cereals or cook cereal doughs and optionally containing a filling of fruit or a confectionery composition.

[009] The present invention provides a novel approach to the formation of laminated multilayered cereal pieces of surprisingly appealing pastry-like texture. The present invention resides importantly in forming a multiplicity of unusually thin layers combined to form a bed or mass which upon controlled compression to include interstitial voids, which when formed into pieces and dried or toasted, create this unique texture. The present invention includes a novel and useful process by which such novel R-T-E cereal pieces can be realized.

## SUMMARY OF THE INVENTION

[010] Disclosed are multi-layered, cereal pieces. The cereal pieces comprise at least four and up to about 20 discrete layers each 100 – 500 micrometers ("μm") thick and each fabricated from cooked cereal dough. The cereal pieces have a bulk density ranging from about 0.06 to 0.4g/cc, and each weigh about 0.2-10g. The cereal pieces are essentially characterized by a laminate structure of a multiplicity of intermediate cereal dough flakes or layers each having a

finished volume the same as its initial volume. The pieces include interstitial voids intermediate the layers ranging from about 0.1 to 4 mm in thickness and averaging about 0.8 mm. The cereal pieces preferably include a topical coating.

[011] In its method aspect, the present invention resides in comprising the steps of: providing

5 a compressed laminated cereal dough bed or mass having a multiplicity of distinct horizontally extending parallel thin layers each fabricated from a cooked cereal dough; forming individual pieces from the laminated sheet, drying the pieces to 2% to 6% moisture, and optionally applying a topical coating.

## BRIEF DESCRIPTION OF THE DRAWINGS

10 [012] Figure 1 is an enlarged photograph showing a side view of a cereal piece of the prior art.

[013] Figure 2 is an enlarged photograph of a representative cereal piece of the present invention.

[014] Figure 3 depicts a quantity of cereal pieces of the present invention disposed in a cereal bowl useful as a R-T-E cereal product.

15 [015] While not essential to describing the present invention to one skilled in the art, the photographic view included herein are presented in conjunction with specific examples to provide a visualization of what is verbally described in the specification.

## DETAILED DESCRIPTION OF THE INVENTION

[016] The present invention provides laminated multi-layered cereal pieces of horizontally aligned thin generally parallel layers with interstitial voids, and their methods of preparation. 20 Each of the product preparation steps are described below in detail.

[017] Throughout the specification and claims, percentages are by weight and temperatures in degrees Centigrade, unless otherwise indicated.

[018] Referring now briefly to the photograph that is Fig 2, it can be seen that generally, the present cereal pieces are fabricated from and comprise a multiplicity of thin generally parallel layers ranging from four to 20 layers and preferably about 5 to 15 cereal layers and for best results about 8-12 layers. In contrast, it can be seen in Figure 1, a prior art product, that flakes are aligned in random order with as many in one direction as another. In Figure 2, it is seen that

while certain layers of the present cereal pieces have an undulating or scalloped appearance, the layers are generally parallel and are distinguished from the small flakes of random orientation of the product shown in Figure 1. In the present products, each cereal layer can range in thickness from 100 – 500 micrometers (“ $\mu\text{m}$ ”), more preferably 200 - 400 micrometers. Each cereal layer

5 is fabricated from a cooked cereal dough. The layers can be fabricated from the same cooked cereal dough formulation, or one or more layers can be fabricated from different cooked cereal dough formulations. For example, one layer can be fabricated from a whole wheat cooked cereal dough while other layers can be fabricated from a rice based cooked cereal dough while still another layer(s) can be fabricated from a corn based cooked cereal dough. In still other 10 variations, a particular layer can be fabricated from a quantity of flakes. To obtain the desired laminate appearance and pastry like texture, importantly, the flakes are not only characterized by a thickness feature but also by a major surface area averaging at least  $2\text{cm}^2$ . In contrast, prior products are characterized by smaller flakes having smaller average individual surface areas on the order of 0.1 to  $0.8\text{ cm}^2$ . The flakes can be fabricated from cooked cereal doughs of identical 15 or different formulation. Preferably, when layers are fabricated from ribbons or flakes, the number of individual ribbons or flakes comprising a single layer will not exceed three. In preferred variations, the layers or at least a majority of the cereal layers are imperforate, i.e., are to be distinguished from layers fabricated from shreds or mesh or dough sheets having grid configurations of holes or perforations.

20 [019] Figure 2 further shows that the cereal pieces exhibit a multiplicity of interstitial void spaces or channels between layers. These interstitial voids can range from about 0.1 to 4 millimeters and in the preferred embodiment average about 0.8 millimeters.

25 [020] The cereal pieces are dried to shelf stable moisture contents. Good results are obtained when the moisture content is 6% or less with better results with moisture contents ranging from about 2% to 4%.

[021] The cereal pieces exhibit appealing and unique pastry-like eating quality due importantly to the combination of a multiplicity of thin layers and voids.

[022] The topical surface of the cereal pieces can optionally include additional appearance features such as corrugations or ripples to enhance visual appeal or eating quality.

30 [023] The cereal pieces can additionally comprise various particulates intermixed with the layers as further described below. In still other variations, the cereal pieces can include one or

more low moisture layers of non-cereal material such as granular sugar, freeze-dried fruit, a dried fruit puree, a chocolate layer, a crème filling layer (e.g., a mixture of fat and sugar), a peanut butter layer and mixtures thereof.

[024] Also if desired, the pieces can include a topical coating such as a sugar syrup coating, a

5 fat or oil coating, e.g., a confectionery fat or chocolate coating, a powdered sugar coating, e.g., flavored with ground cinnamon, or non-nutritive sweetener blend.

[025] As seen in Figure 3 which shows a quantity of bite-sized pieces in a cereal bowl, for R-T-E cereal products, the products can be fabricated into bite sized pieces of convenient size and shape. Good results are obtained when a quantity of pieces has piece count of about 6 to 20 per

10g. Preferred for use herein are pieces further characterized by low aspect ratios, e.g. less than 3:1 of longest to shortest dimension, especially those of regular shapes, e.g., cubes, disks or cylinders, parallelograms or biscuits although other more complex shapes are contemplated. Of course, smaller or larger sized pieces (such as for grain based snacks) can be practiced.

Uncoated pieces having the good piece count range are characterized by a bulk density of about  
15 0.06 to 0.4g/cc, preferably about 0.1 to 0.25 g/cc.

[026] The first essential step of the present cereal product preparation process is to provide a compressed laminated cereal dough bed or mass having a multiplicity of distinct horizontally extending parallel thin layers each fabricated from a cooked cereal dough. The art is replete with teachings and methods for preparing cooked cereal dough compositions and forming such  
20 compositions into sheets or flakes. The skilled artisan will have no difficulty in providing such cooked doughs as a starting material.

[027] Generally, however, in the conventional preparation of cooked cereal doughs, the essential cereal ingredients and other ingredients such as cereal fines and/or regrinds are combined with water and heat and mild pressure to cook or gelatinize the starchy component of  
25 the cereal ingredients. Thereafter, the cooked cereal is combined with the other ingredients and mixed with low or high shearing to form the cooked farinaceous dough.

[028] A variety of well-known cooking methods and equipment can be used to prepare cooked cereal doughs. For example, the cereal blend can be processed in a cooker extruder or in a pressurized and agitated steam cooker each of which form a cooked cereal dough. In another  
30 variation, the cooking and dough forming steps are performed simultaneously in a conventional high pressure, high shear cooker extruder (e.g., single screw or twin screw extruder). In still

other variations, the cereal materials can be partially cooked or conditioned in one vessel (e.g., a steam conditioner) and then finish cooked in second vessel (e.g., a single screw extruder).

[029] In the preparation of whole grain based cooked cereal doughs, the whole grains typically require or benefit from extended cooking times. Traditional, low pressure, low shear, extended

5 cook time batch or semi-continuous cookers can be used. The whole grains (whether as intact grains or cut into various sized particles) such as whole wheat are added to water, salt and optionally malt and/or sugar(s) and cooked for extended times to form a cooked whole grain cereal having a desirable cooked flavor. In another variation, the whole grain, water and minor ingredients can be formed quickly into a cooked cereal dough using a cooker extruder. Since  
10 cook times in a cooker extruder are so short, in one minor variation, the grains are partially cooked in a conditioner with steam (atmospheric or slightly pressurized) prior to being fed to the extruder. Such a preconditioning or partial cooking allows the grain to develop a better cooked flavor.

[030] The term "refined cereal doughs" is used herein in contrast to whole grain cereal doughs.

15 "Refined" cereal doughs as used herein refers to those cooked cereal dough compositions that do not contain whole grain ingredients (i.e., contain less than about 2% whole grain cereal flour ingredients) but comprise conventional white cereal flours. More particularly, refined cereal doughs are essentially characterized herein by a low level of a fiber content (typically supplied by the whole grain ingredient and/or germ ingredient). Refined cereal doughs desirably contain  
20 herein less than about 5% total dietary fiber and less than 2% cereal germ ingredient.

Additionally, refined cereal doughs can comprise "highly refined" cereal doughs. By "highly refined" herein it is meant cereal doughs comprising either pure cereal starch fractions and/or sucrose. Adding pure cereal starches and sucrose each have a beneficial effect on the dough compositions ability to expand. Highly refined cereal dough compositions herein comprise  
25 about 1% to about 25% of a cereal starch ingredient and/or about 10% to 40% by weight of sucrose.

[031] Of course, the cooked cereal doughs can comprise major grain cereals including those of wheat, corn (maize), oats, rice, barley and mixtures thereof. While these major grains are most popular, minor useful grains include amaranth, millet, sorghum, triticale, flax and mixtures  
30 thereof. Within this general outline of cereal processing for the provision of cooked cereal doughs, a wide variety of particular methods and composition variations can be used. Also, the

dough layers can optionally include a variety of ingredients to improve the appearance, taste and nutritive properties including flavors, such as vitamin/mineral fortification, etc.

[032] The present invention is suitable for use in connection with the preparation of whole grain R-T-E cereal products from whole grain based cooked cereal doughs. Even more 5 particularly, the present invention is suitable for use in connection with wheat based flaked R-T-E cereal having the following essential ingredients:

Ingredient	Weight %
Grain (wheat, rice)	>70
Carbohydrate (sugar, maltodextrin, dextrose)	20 – 25
10 Flavor agents (salt, soybean oil)	4 – 6
Processing aids (monoglycerides, tricalcium/trisodium phosphate)	1 – 2
Vitamin/mineral blend	0.05 – 0.5

[033] Desirably, the cooked cereal dough has a moisture content of about 18% to 35% prior to formation of the laminated sheet, preferably 18% to 26%, and more preferably about 18% to 15 20%.

[034] The cooked cereal dough is then formed into thin continuous sheets/ribbons or into a multiplicity of individual flakes to form the layers.

[035] In a first thin continuous ribbons variation, the dough is formed into sheets by conventional means such as by feeding at least one dough rope into one or more sheeting rolls to 20 form the present cooked cereal dough sheets of the requisite thickness of about 0.008-0.015 inch (200 to 400 micrometers or “ $\mu$ m”). Separately, the thin continuous sheets can be longitudinally subdivided into continuous ribbons. The sheet temperature following formation can range from about 25 to 44°C (80-110°F). The thin continuous sheets or ribbons are folded back and forth on itself to form the number of layers desired. The sheets can be fabricated from all the same 25 formulation of cooked cereal dough or each can be of a particular cooked cereal dough formulation. For example, one or more layers can be fabricated from a whole wheat cooked cereal dough while one or more layers can be provided by a cooked cereal dough having other desirable properties, e.g., a second whole grain such as whole grain corn. In still other variations, one or more layers can be fabricated from a cooked cereal dough formulated to be 30 more tender or of a lighter texture to provide lighter texture properties to the finished cereal products. In still other variations, one or more sheet layers can be fabricated from a highly

flavored cooked cereal dough, e.g., cinnamon, or chocolate while other layers provide, for example, high fiber levels.

[036] In a second preferred variation, the cereal dough is first formed into pellets and the pellets then formed into individual wet thin flakes. In this variation, the cooked cereal dough is sheeted to greater thickness, e.g., 1500 to 2500 micrometers (about 0.060 to 0.10 in.), and then cut first into ribbons and then the ribbon are cross cut to form individual pieces or “pellets”, e.g., square or rectilinear. These relatively thicker individual pieces or pellets are preheated to a temperature as hot as possible without pre-puffing (in this application 55 – 65°C) and fed to conventional flaking rolls to form thin warm wet individual flakes ranging in thickness from about 200-400 micrometers (0.008 to about 0.015 in.). The skilled artisan will appreciate that such wet flakes are substantially thinner than wet flakes conventionally used to make flake R-T-E cereals that are typically characterized by a thickness ranging from about 0.20 to about 0.35 inch. The flakes are allowed to fall on top of each other forming the number of desired layers. Using flakes is preferred to a multiplicity of continuous sheets or ribbons of cooked cereal dough. Due to the thinness of the present layers, continuous ribbons are subject to frequent tearing in commercial manufacturing. Depending on the end product desired, the quantities of flakes of one cooked dough composition can be varied. For example, all the flakes can be of one cooked cereal dough formulation.

[037] It should be appreciated that preferably both the thin flakes (individual pieces) and/or the thin continuous ribbons are each substantially imperforate, i.e., are to be distinguished from the nets or woven shreds of cooked cereal dough characteristic of shredded wheat biscuits.

[038] While still moist and warm, the thin ribbons and/or thin flakes are formed into a bed or mass of thin horizontally oriented parallel layers characterized as being visually distinct with interstitial voids. The total number of layers can range from at least four to about 20.

Once the layers are formed, it is important that at least a portion of the layers be bound together to prevent total delaminating upon further processing and complete separation of the layers from each other. In certain embodiments, only end regions or middle regions of the layers are bound together. This partial bonding is accomplished by applying a compressive force on the layered warm and wet cereal dough. Optimal bonding dough conditions have been found to be at a bed temperature ranging from 25 to 44°C (80-110°F) and bed moisture ranging from 16-20% moisture. The warmer and wetter the dough, the less visibly distinct the layers can become,

however the cooler and dryer the dough, the less partial bonding occurs. Good results are obtained with sufficient compression to reduce the bed thickness from 100% to a compressed thickness ranging from about 35 to 65 % of its original or uncompressed thickness. The bed thickness generally ranges from about 15 –50 mm, preferably about 25-35 mm in thickness

5 before compression, and 10-20 mm in thickness after compression, preferably about 10-15 mm. The compressing step can be practiced using conventional sheeting apparatus, generally one or more pairs of counter-rotating compression rollers or belts. Good results are obtained using pressures ranging from about 10 to 50 psi (6 to 300 kPa), preferably about 25 psi. Increased compression reduces the amount and degree of voids and channels.

10 [039] Unlike the fabrication of granola bars, the mass of cereal flakes is generally not admixed with a binder material such as a sugar syrup. If desired, layer bonding can be increased by employing various additives. For example, the products can optionally comprise one or more layers of a sticky fruit paste layer.

[040] Also, the layers can be intermixed with a wide variety of extra small particles or particulates. Such particulates can comprise any solid particulate material to provide the finished R-T-E cereal pieces with desired visual, nutritional and/or organoleptic attributes. For example, the extra particles can comprise candies, dried fruit bits, nut pieces (e.g., almonds, coconut, hazel, peanut, and mixtures thereof), seeds (e.g., flax, poppy, sesame), dried marshmallow pieces or flakes, texturized vegetable protein, ground sugar, or non-nutritive sweetner blends can be intermixed with the wet flakes or continuous ribbons. Good results are obtained when the extra particles comprise about 1% to about 30%, preferably about 5% to 15% of the finished product. While the particle size of the extra particles is not critical, good results are obtained when the extra particles range from about 0.1 to 3 mm.

25 [041] Optionally, the laminated sheets or ribbons can be fabricated with additional non-cereal intermediate layers and/or materials. For example, the laminated sheets can be fabricated with an intermediate sweetened fruit puree layer. An exemplary suitable fruit composition has the following formulation:

<u>Ingredient</u>	<u>Weight %</u> <u>(dry weight)</u>
Fruit puree solids	10% - 60%

Carbohydrate sweeteners	0% - 50%
Glycerin	10% - 20%
Moisture	2% - 10%

[042] Since the moisture is removed subsequently, the moisture content of the fruit layer is selected for convenience.

[043] The intermediate fruit layer(s) can be applied over the intermediate cereal dough layer prior to formation of the laminated sheet or continuous ribbon. The fruit layer can range in 5 thickness from about 2,000 to 4,000  $\mu\text{m}$  (0.080 to 0.160 inch).

[044] In other variations, a fat-based layer of like thickness can be employed, e.g., a frosting, or a "summer" confectioner's composition, or a peanut or other nut butter spread.

[045] Next, the compressed bed of cereal dough sheets/ribbons or flakes can be formed into individual pieces of desired shape and size. Conventional cutting, stamping, or molding techniques and equipment can be used to practice this step. Generally, larger pieces are prepared for snack applications compared with the generally smaller pieces used for R-T-E cereals. In preferred variations, the sheets are cut into nested or tesserated shapes such as triangles, squares, rectangles or parallelogram shaped so as to minimize regrinds. The individual pieces can range in size from about 0.1 to about 10g each when finish dried, preferably about 0.5 to 5g.

[046] In still other variations, the compression and piece forming steps can be practiced simultaneously such as when crimping rolls both compress and form individual pieces. In still other variations, the crimping rolls can be machined with surfaces designed to impart surface feature or texture to the pieces such as ribbing or ripples to enhance their appeal.

[047] In the next essential step, the laminated pieces so formed into individual pieces are 20 dried/toasted to a finished product moisture of 2% to 6%, preferably about 2% to 4%. In one variation, the individual wet pieces of moisture 16-18% can be dried to an intermediate moisture of 9-11% via a conventional belt multi-pass dryer, with a subsequent belt toaster or air impingement dryer completing the drying and toasted to a finished moisture of 2-6%, preferably about 2-4%. In another variation, the individual wet pieces of moisture 16-18% can be directly 25 dried and toasted to the final moisture of 2-6%, preferably about 2-4% via a band oven. In preferred variations, the drying step is practiced quiescently, i.e., with minimal agitation, to minimize product breakage and delamination.

[048] The resultant laminated dried and toasted products are generally characterized by a cumulative layer thickness of about the same as the wet compressed bed of layered cereal dough sheets, ribbons, or flakes 10 mm to 20 mm. For better results in terms of hardness of the final product, the pieces have cumulative thicknesses ranging from about 10 to 15 mm.

5 [049] The present methods can optionally comprise a scalping step to remove cereal fines and broken pieces. The scalped material or recoup material can be recycled and added to the dry cereal materials used to prepare the cooked cereal doughs.

[050] The present methods can further optionally comprise the step of applying a topical coating to the laminated dried cereal pieces.

10 [051] Conveniently, this step can comprise a first sub-step of applying a first base or tacky coating and then applying a second top or non-tacky or finish coating. Conveniently, the base or tacky coating can be a liquid such as an oil or sugar syrup or oil/syrup binder or slurry while the finish coating can be a particulate material. The ratio of cereal pieces to topically coating can range from about 1-20:1, preferably about 1-5:1 and for best results about 4:1.

15 [052] For example, the dried laminated pieces can be sprayed with about 5 – 10% oil or a liquid binder to form tacky or oil coated dried laminated cereal pieces. Thereafter, the tacky or oil coated dried laminated cereal pieces can be dusted with a powder coating such as a blend of powdered sugar and cinnamon (e.g. in a 10:1-3 ratio of sugar to cinnamon). In still other variations, the second dry coating can include any of the particulate materials whether the same or different from any particulates added intermediate to the cereal layers. In variations intended for snack products, the second top coating can comprise a seasoning blend and/or dried cheese powder.

20 [053] In certain other preferred variations, the pieces additionally include a conventional presweetening topical coating. Well known compositions and presweetener coating application techniques can be employed both for sugar coating or when various high potency sweeteners, e.g., aspartame, sucralose, or potassium acetylsulfame are used. In more preferred embodiments, the presweetening coating comprises sugar and/or corn syrup, a flavor constituent, oil and/or vitamins. The addition of a flavor constituent to the sugar coating solution is preferred due to flavor losses that can occur from the frying, toasting or puffing steps practiced herein. These

steps, due to their heat application, tend to drive off the volatile flavor constituents leading to flavor degradation or loss.

[054] The finished, laminated R-T-E cereal products include both 1) regular and 2) presweetened and/or coated products prepared therefrom.

5 [055] The multi-layered cereals products prepared as described can be packaged and distributed in conventional manner.

[056] Without further elaboration, it is believed that one skilled in the art can, using the preceding description, utilize the present invention to its fullest extent. The following preferred specific embodiments are, therefore, to be construed as merely illustrative and not limitative of 10 the remainder of the disclosure. It will be appreciated that other modifications of the present invention, within the skill of the R-T-E cereal art, can be undertaken without departing from the spirit and scope of the invention.

#### Example 1

[057] A laminated multi-layered R-T-E cereal of the present invention is prepared according to 15 the following process. Three individual batches of cooked cereal dough were prepared. Separate formulas are used, containing the following ingredients and percents by weight (dry basis).

#### Formula No. 1

##### White Rice Formula

	<u>Ingredient</u>	<u>Weight %</u>
20	White rice flour	70.0
	Brown rice flour	13.0
	Sugar	7.7
	Soybean oil	3.0
25	Salt	1.0
	Wheat starch	5.2
	Trisodium phosphate	<u>0.1</u>
		100.0%

Formula 2  
Yellow Corn

<u>Ingredient</u>	<u>Weight %</u>
Yellow corn cones	72.0
Oat flour	5.5
Wheat flour	10.0
Sugar	8.0
Soybeanoil	2.0
Salt	<u>2.5</u>
	100.0%

Formula 3

Brown Wheat

<u>Ingredient</u>	<u>Weight %</u>
Cut wheat	40.0
Rice flour	33.0
Sugar	15.0
Soybean oil	3.5
Dextrose	4.3
Salt	2.5
Non-fat dry milk	<u>1.7</u>
	100.0%

Individual batches of the above formula were prepared.

[058] The doughs were separately cooked in conventional manner using a single screw cooker extruder with preconditioning. The doughs were cooked to a moisture of approximately 18% to 25 20% and a temperature of 270 - 290°F (132 - 143°C).

[059] The warm, cooked, colored doughs were then formed into sheets using a conventional sheeter/forming roll with one corrugated face to form three individual sheets each having one major face having corrugations. The moisture was 18% to 20% and the temperature was approximately 100°F (38°C).

[060] Thereafter, multiple dough sheets of all three formulas were stacked horizontally with each corrugated face positioned downwardly. The layered sheets so stacked and arranged were then fed to a set of compression rolls to form a laminated sheet.

[061] This multiple layered sheet was then cut into various shapes and sizes using a conventional rotary cutting unit. The shapes included squares, hexagons, triangles and parallelograms.

[062] The shaped pieces were then dried from 18% to 20% moisture down to approximately 10% moisture. The drying unit was a conventional forced air convection dryer. The pieces were dried at 82°C (180°F) for 30 minutes.

[063] The dried pieces were then finish dried and toasted in a band oven at 200 °C for about 10 minutes. The product density was 0.22 grams per cubic centimeter . The final moisture was approximately 2% to 3%.

[064] The cereals products so prepared were characterized by having a plurality of layers that were visibly discrete.

### Example 2

**[065]** A variation of the above is to produce a multiple layer piece in which a fruit layer is substituted for one of the intermediate cereal dough layers.

[066] The cooking, sheet forming, cutting, drying and toasting methods are all similar to Example 1.

20 [067] The fruit layer had the following composition:

<u>Ingredient</u>	Weight %
Strawberry solids	28
Carbohydrate sweetners	55
Stabilizer	4
Glycerin	12
Others	<u>1</u>
	100.00%

[068] Finished R-T-E cereals of equivalent properties are prepared when the strawberry ingredient is replaced with equivalent amounts of cherry, blueberry, grape, raspberry, apricot, pear, raisin, date, fig and mixtures thereof.

Example 3

5 [069] Another variation employing a process similar to that of Example 1 is to produce a, multi-layered R-T-E cereal that is topically coated with sugar/flavor. The topical coating can be applied by an aqueous sugar/flavor slurry which is subsequently dried, or a dry blend of sugar/flavor can be adhered to the cereal by a sticky ingredient such as soybean oil, starch, or sugars.

10 [070] An aqueous sugar/flavor slurry is as follows:

Ingredient	Weight%
Sucrose	67
Corn Syrup	12
Flavor	1
Water	<u>20</u>
	100%

[071] The slurry is applied in a conventional manner by spraying the sugar based slurry, with or without flavor additive, onto the dried/toasted cereal pieces. The coated pieces are then dried down to approximately 2% moisture in a conventional forced air dryer.

20 [072] A dry sugar/cinnamon blend adhered by soybean oil is as follows:

Ingredient	Weight%
Sucrose	97
Cinnamon	3
	100%

25 [073] The sucrose granulation is more finely ground than table sugar (30% max through a #120 US standard sieve). Soybean oil is sprayed on the dried/toasted cereal pieces in a ratio 1:9 and the dry sugar/cinnamon blend is sprinkled onto the oil coated cereal pieces in a ratio of 1:3.